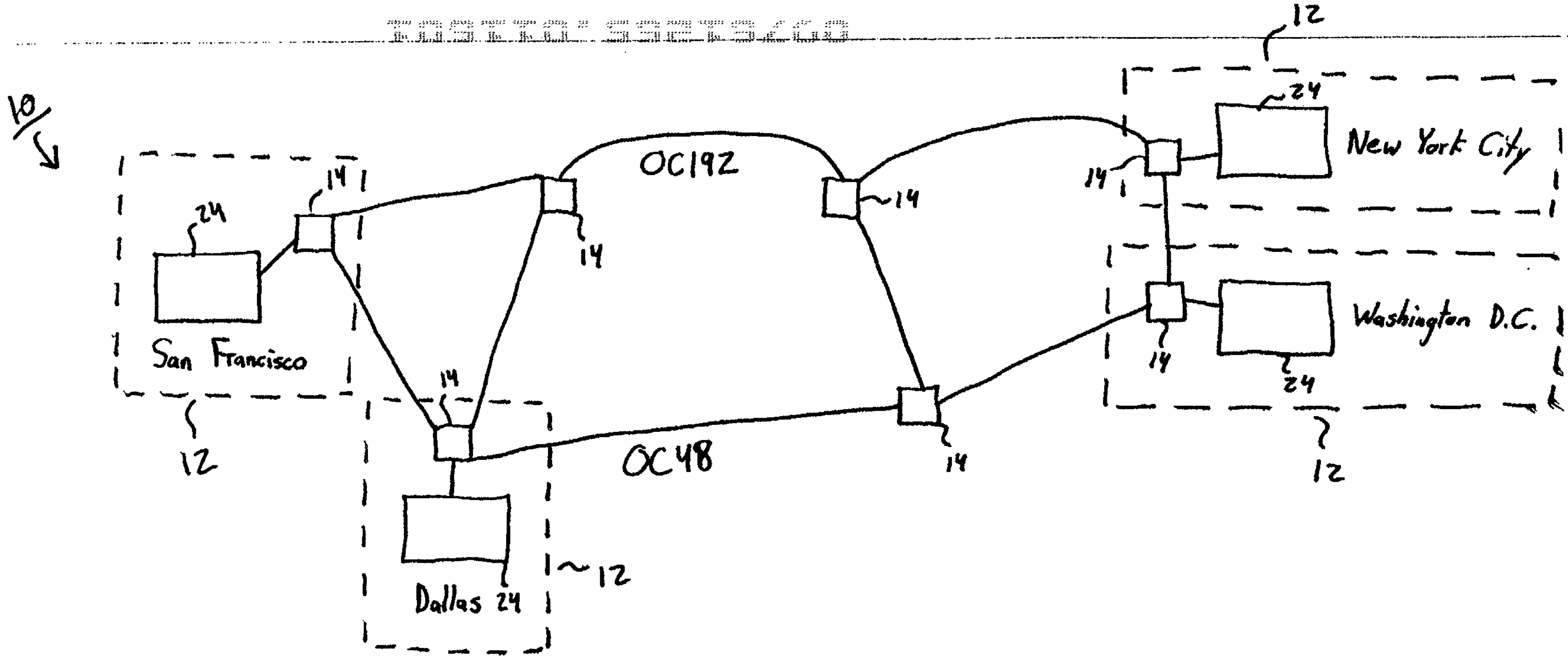

10
12
24
14
New York City
OC192
San Francisco
Washington D.C.
Dallas
OC48

Fig. 1A

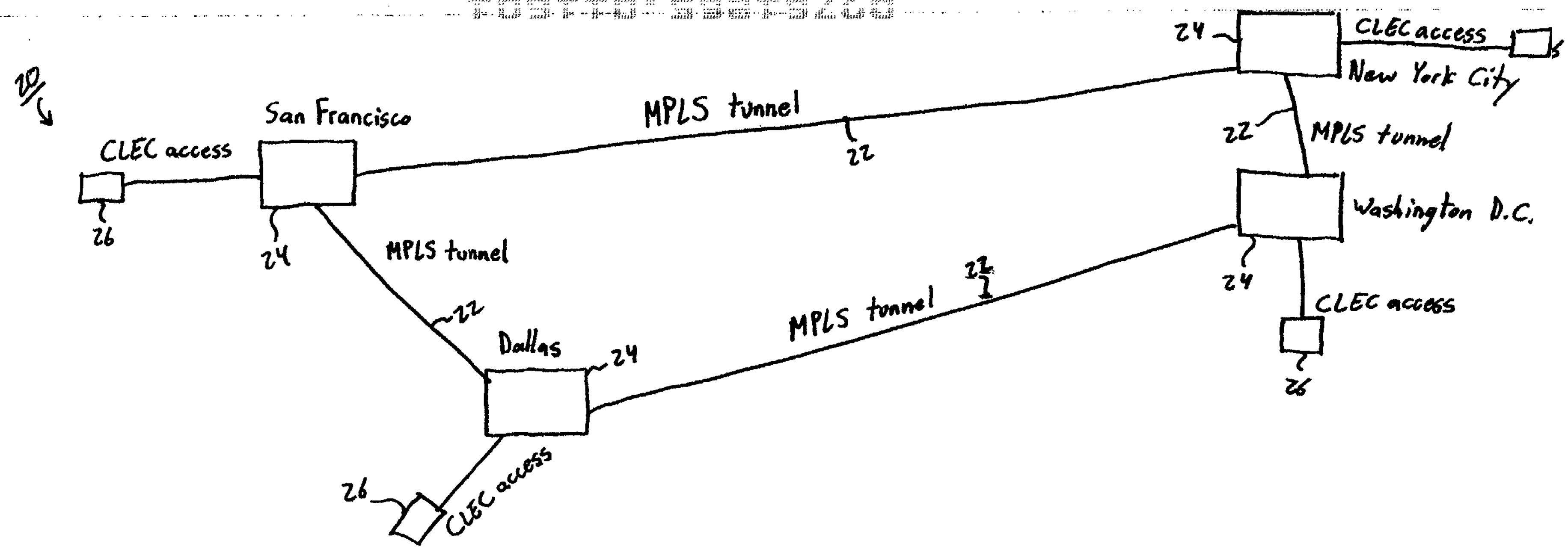
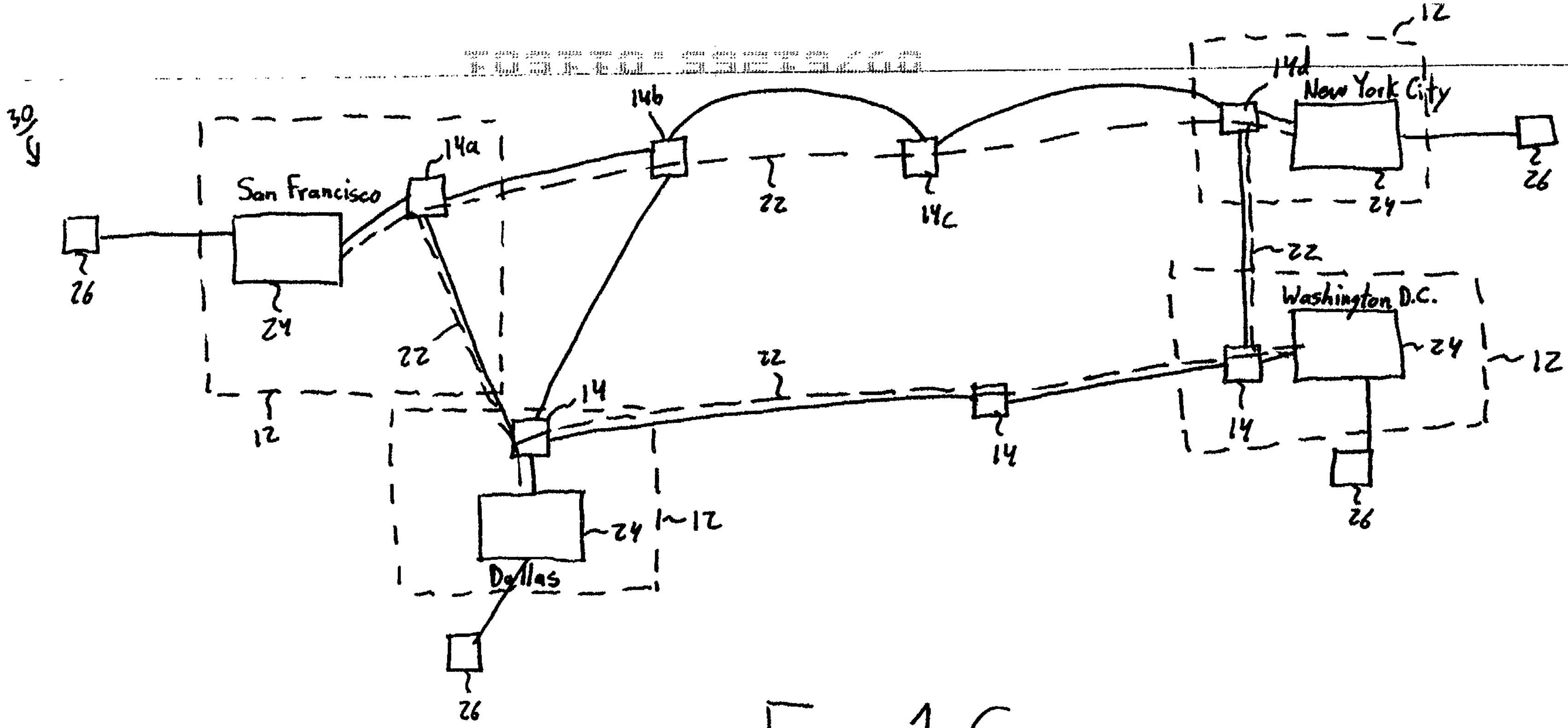

10
San Francisco
CLEC access
26
24
MPLS tunnel
22
MPLS tunnel
22
Dallas
24
CLEC access
26
MPLS tunnel
22
24
CLEC access
New York City
22
MPLS tunnel
Washington D.C.
24
CLEC access
26

Fig. 1B



30
San Francisco
14a
14b
14c
14d
New York City
Washington D.C.
Dallas
12
14
22
24
26

Fig 1C

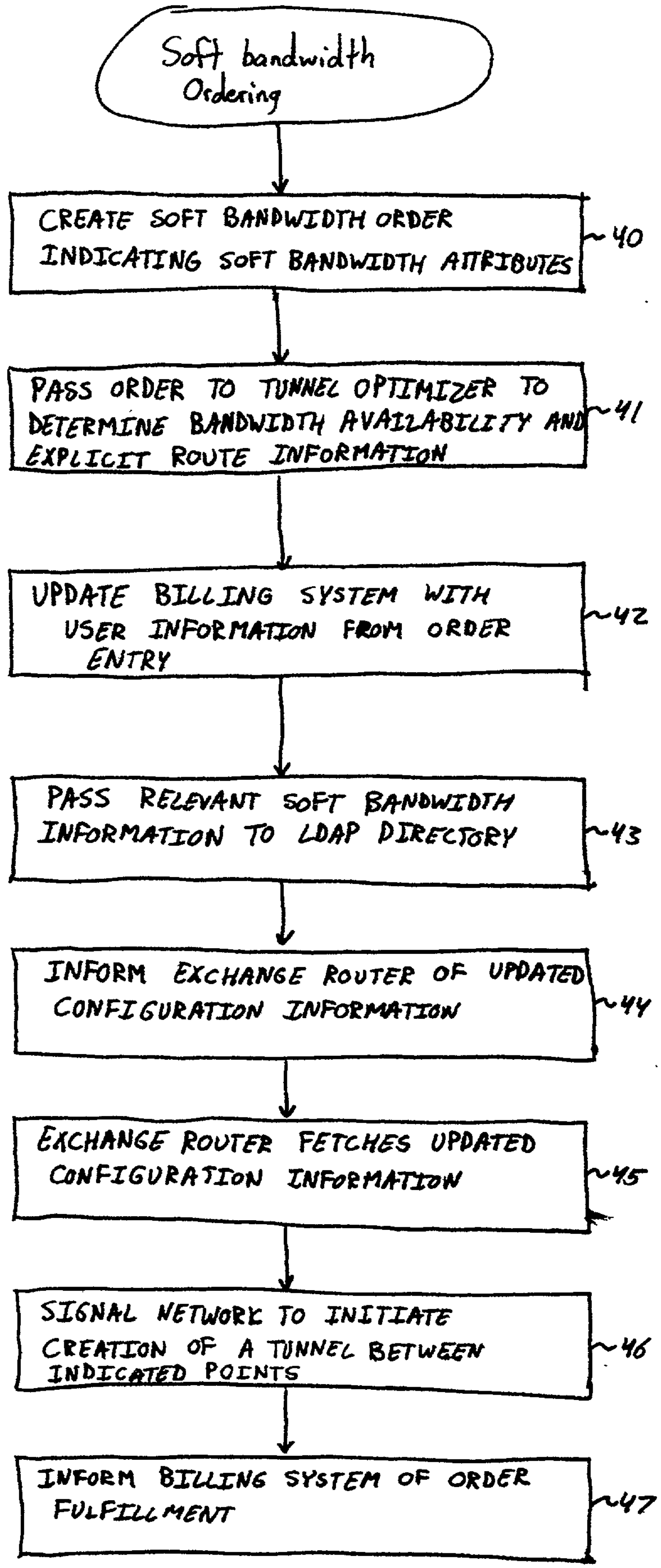

Soft bandwidth Ordering
CREATE SOFT BANDWIDTH ORDER INDICATING SOFT BANDWIDTH ATTRIBUTES
40
PASS ORDER TO TUNNEL OPTIMIZER TO DETERMINE BANDWIDTH AVAILABILITY AND EXPLICIT ROUTE INFORMATION
41
UPDATE BILLING SYSTEM WITH USER INFORMATION FROM ORDER ENTRY
42
PASS RELEVANT SOFT BANDWIDTH INFORMATION TO LDAP DIRECTORY
43
INFORM EXCHANGE ROUTER OF UPDATED CONFIGURATION INFORMATION
44
EXCHANGE ROUTER FETCHES UPDATED CONFIGURATION INFORMATION
45
SIGNAL NETWORK TO INITIATE CREATION OF A TUNNEL BETWEEN INDICATED POINTS
46
INFORM BILLING SYSTEM OF ORDER FULFILLMENT
47

Fig. 2

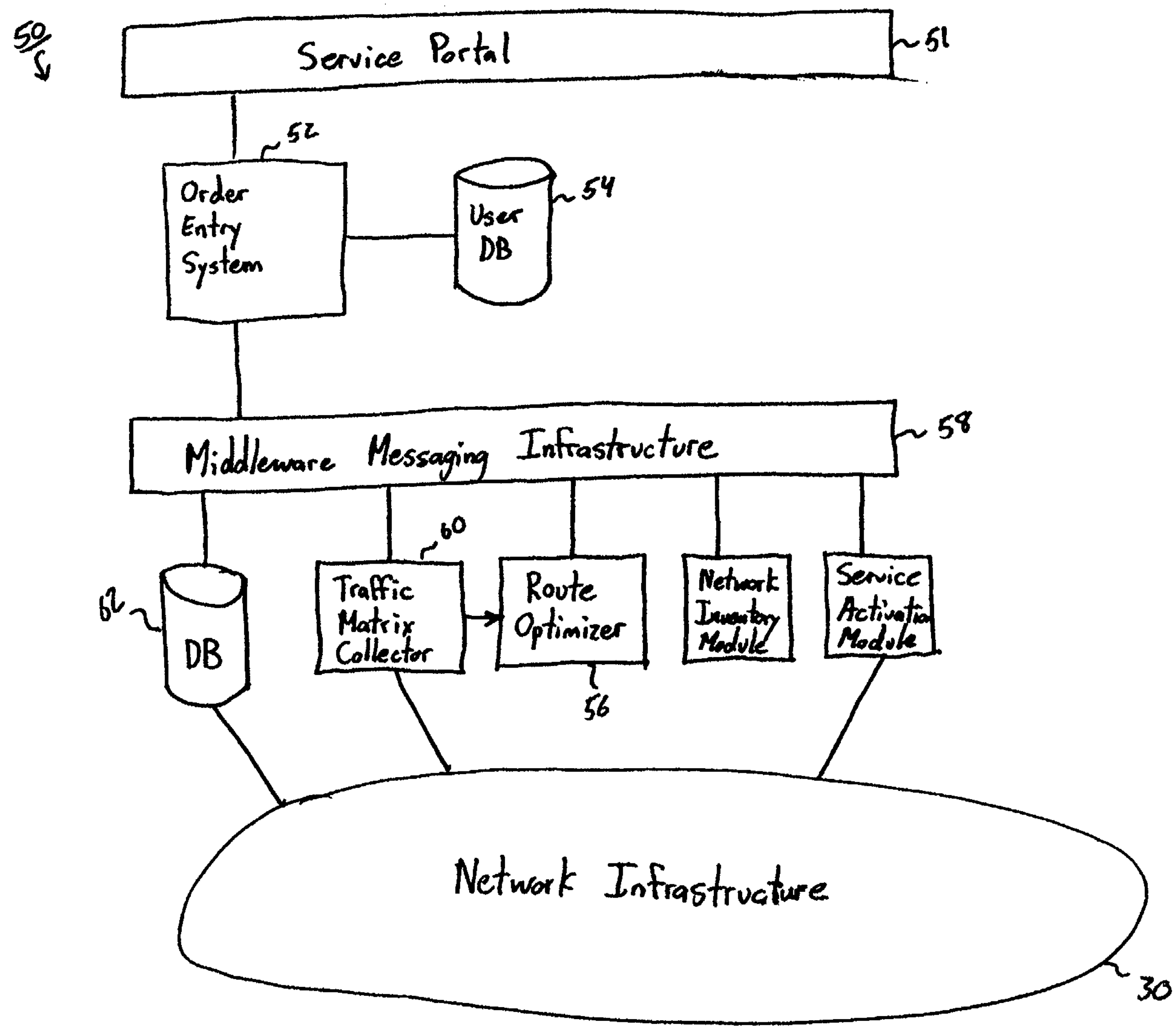

50
Service Portal
51
52
Order Entry System
User DB
54
Middleware Messaging Infrastructure
58
60
62
DB
Traffic Matrix Collector
Route Optimizer
56
Network Inventory Module
Service Activation Module
Network Infrastructure
30

Fig. 3

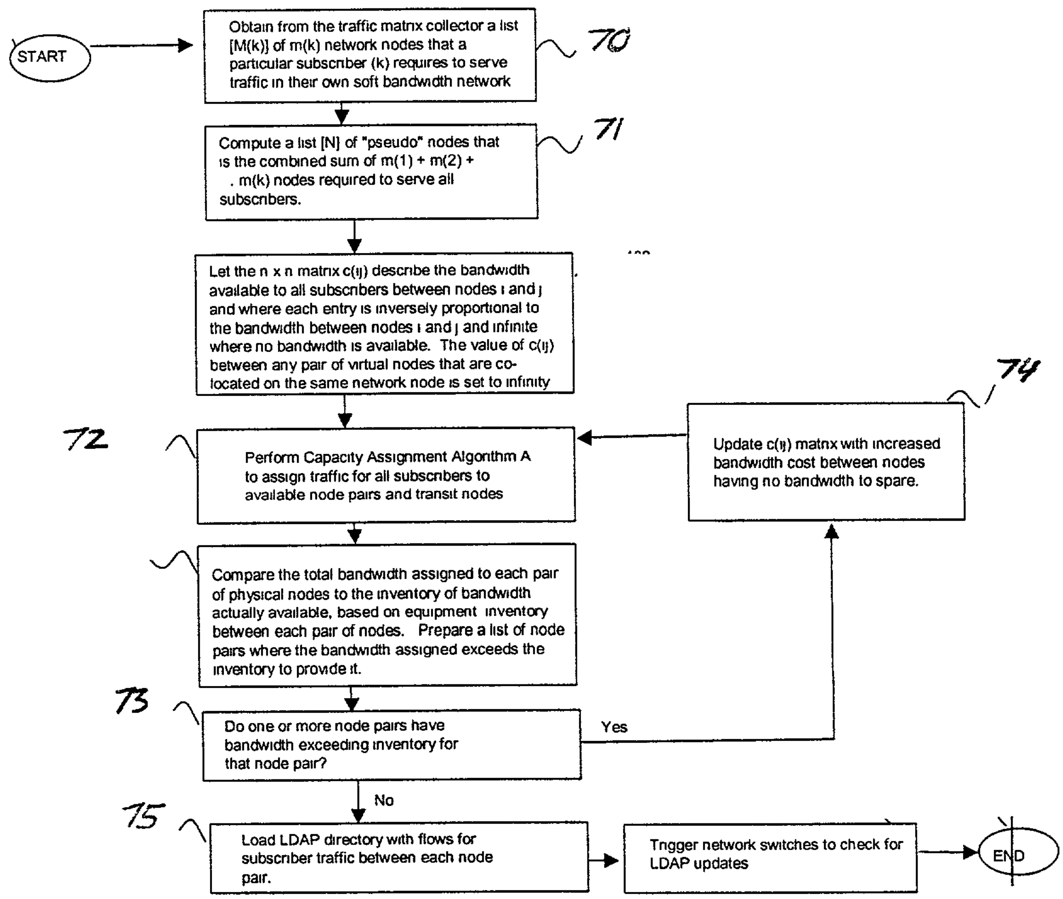

START
Obtain from the traffic matrix collector a list [M(k)] of m(k) network nodes that a particular subscriber (k) requires to serve traffic in their own soft bandwidth network
70
Compute a list [N] of "pseudo" nodes that is the combined sum of m(1) + m(2) + . m(k) nodes required to serve all subscribers.
71
Let the n x n matrix c(ij) describe the bandwidth available to all subscribers between nodes i and j and where each entry is inversely proportional to the bandwidth between nodes i and j and infinite where no bandwidth is available. The value of c(ij) between any pair of virtual nodes that are co-located on the same network node is set to infinity
72
Perform Capacity Assignment Algorithm A to assign traffic for all subscribers to available node pairs and transit nodes
74
Update c(ij) matrix with increased bandwidth cost between nodes having no bandwidth to spare.
Compare the total bandwidth assigned to each pair of physical nodes to the inventory of bandwidth actually available, based on equipment inventory between each pair of nodes. Prepare a list of node pairs where the bandwidth assigned exceeds the inventory to provide it.
73
Do one or more node pairs have bandwidth exceeding inventory for that node pair?
Yes
No
75
Load LDAP directory with flows for subscriber traffic between each node pair.
Trigger network switches to check for LDAP updates
END

Fig 4

80

Input: A list [N] of n network nodes having adequate equipment inventory to serve originating traffic and via traffic.

An n x n matrix [c(ij)] where each entry in the matrix is inversely proportional to the service bandwidth available between nodes i and j. Where there are no communications facilities directly connecting nodes i and j, the cost c(ij) is set to infinite.

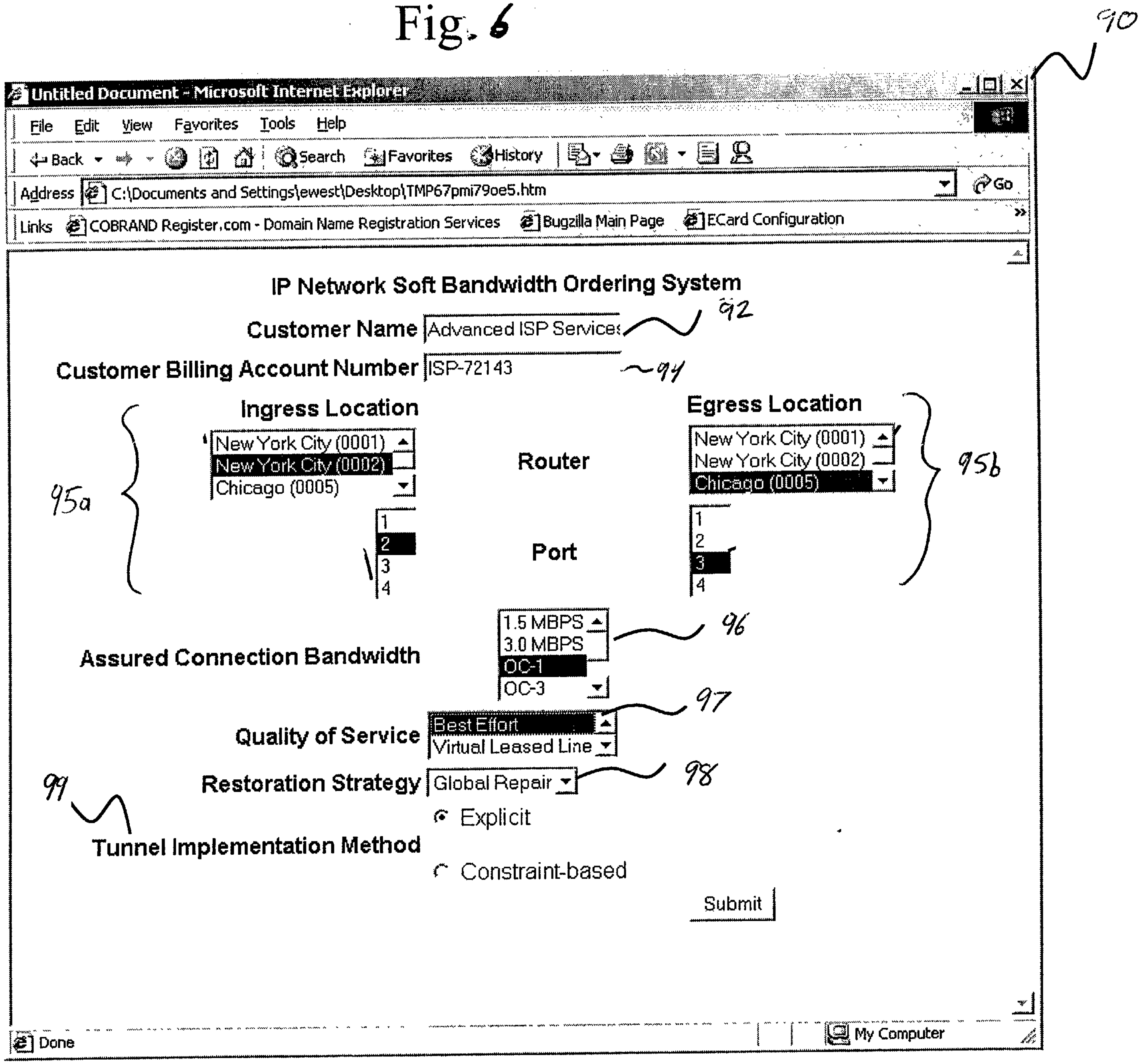
Algorithm:
(Floyd-Warshall, 1962)

```
begin
    for all i not equal to j    do  d[ij] = c[ij];
    for i = 1,....n do d[ii] = infinity;
    for j = 1,....n do
      {
       for i = 1,....n , except i=j do
          {
           for k = 1,....n,   except k=j   do
              {
                d[ik] = min{ d[ik], d[ij] + d[jk]}
                if d[ik]> d[ij+d[jk]
                   {
                    e[ik] = j
                   }
                 else
                   {
                     e[ik] = 0
                   }
               }
           }
       }
 end
```

Output: The route that a particular demand between any two points i and j may be found by looking up intermediate transit nodes found as values at the intersection of row i and column j in the n x n matrix e[ij].

Fig. 5

Fig. 6


90
Untitled Document - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History
Address C:\Documents and Settings\ewest\Desktop\TMP67pmi79oe5.htm
Go
Links COBRAND Register.com - Domain Name Registration Services Bugzilla Main Page ECard Configuration
IP Network Soft Bandwidth Ordering System
Customer Name Advanced ISP Services
92
Customer Billing Account Number ISP-72143
94
Ingress Location
Egress Location
New York City (0001)
New York City (0002)
Chicago (0005)
Router
Port
1
2
3
4
95a
95b
Assured Connection Bandwidth
1.5 MBPS
3.0 MBPS
OC-1
OC-3
96
Quality of Service
Best Effort
Virtual Leased Line
97
Restoration Strategy
Global Repair
98
99
Tunnel Implementation Method
Explicit
Constraint-based
Submit
Done
My Computer

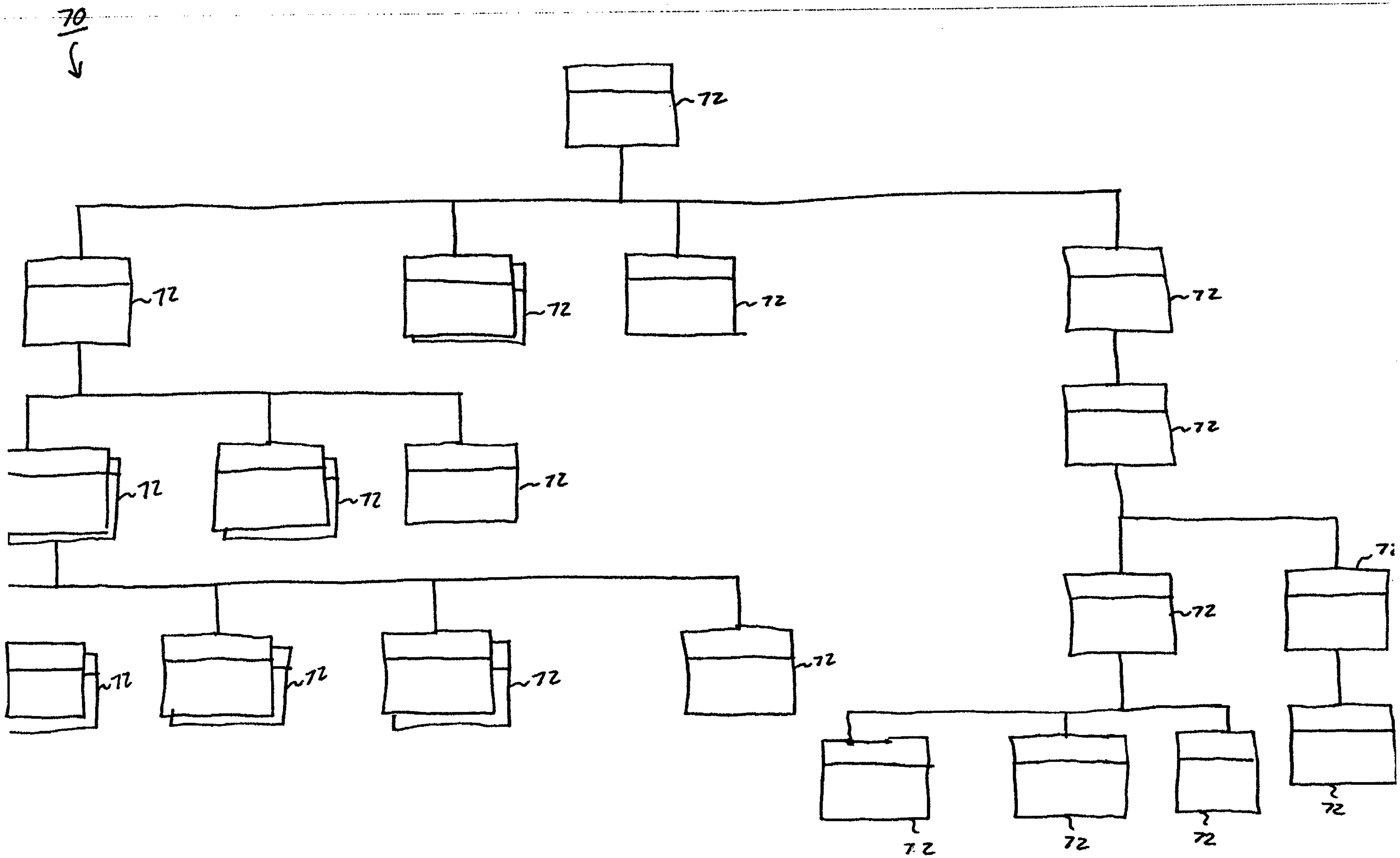


Fig. 7

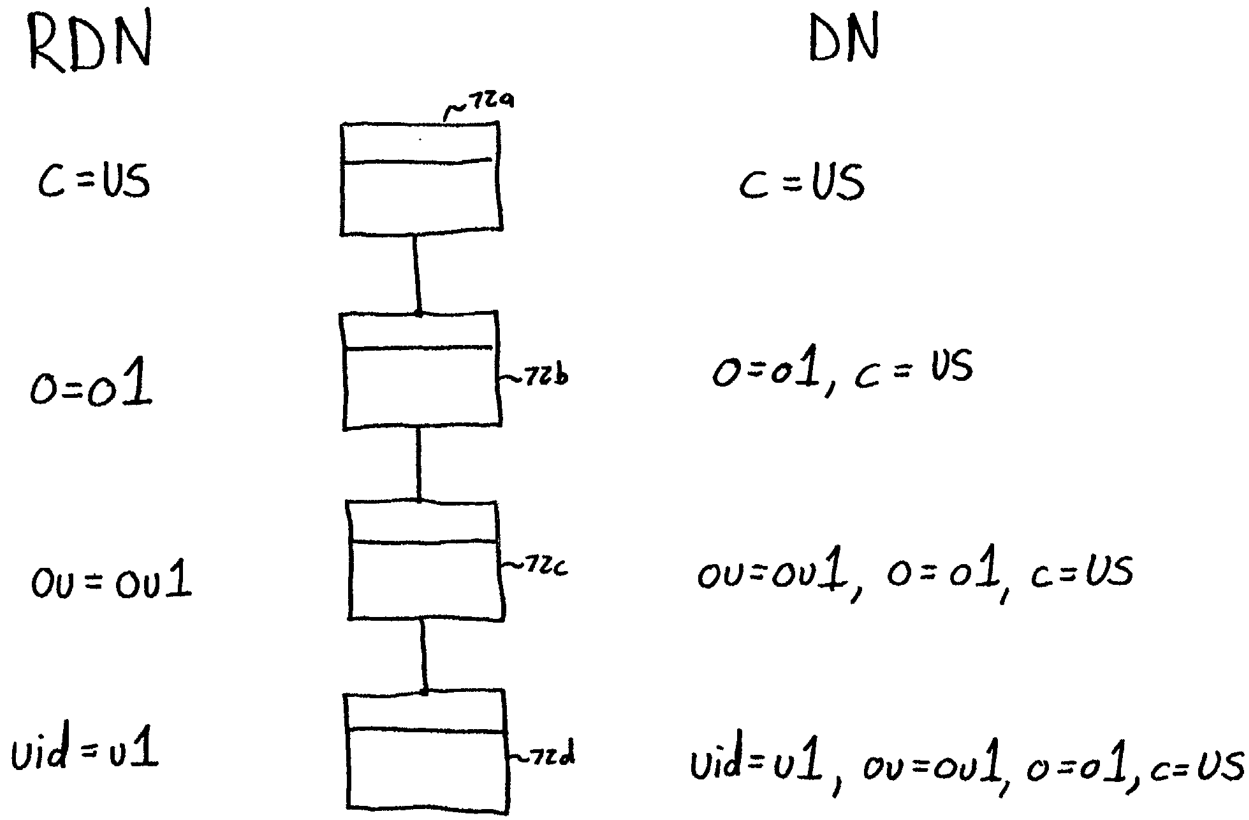
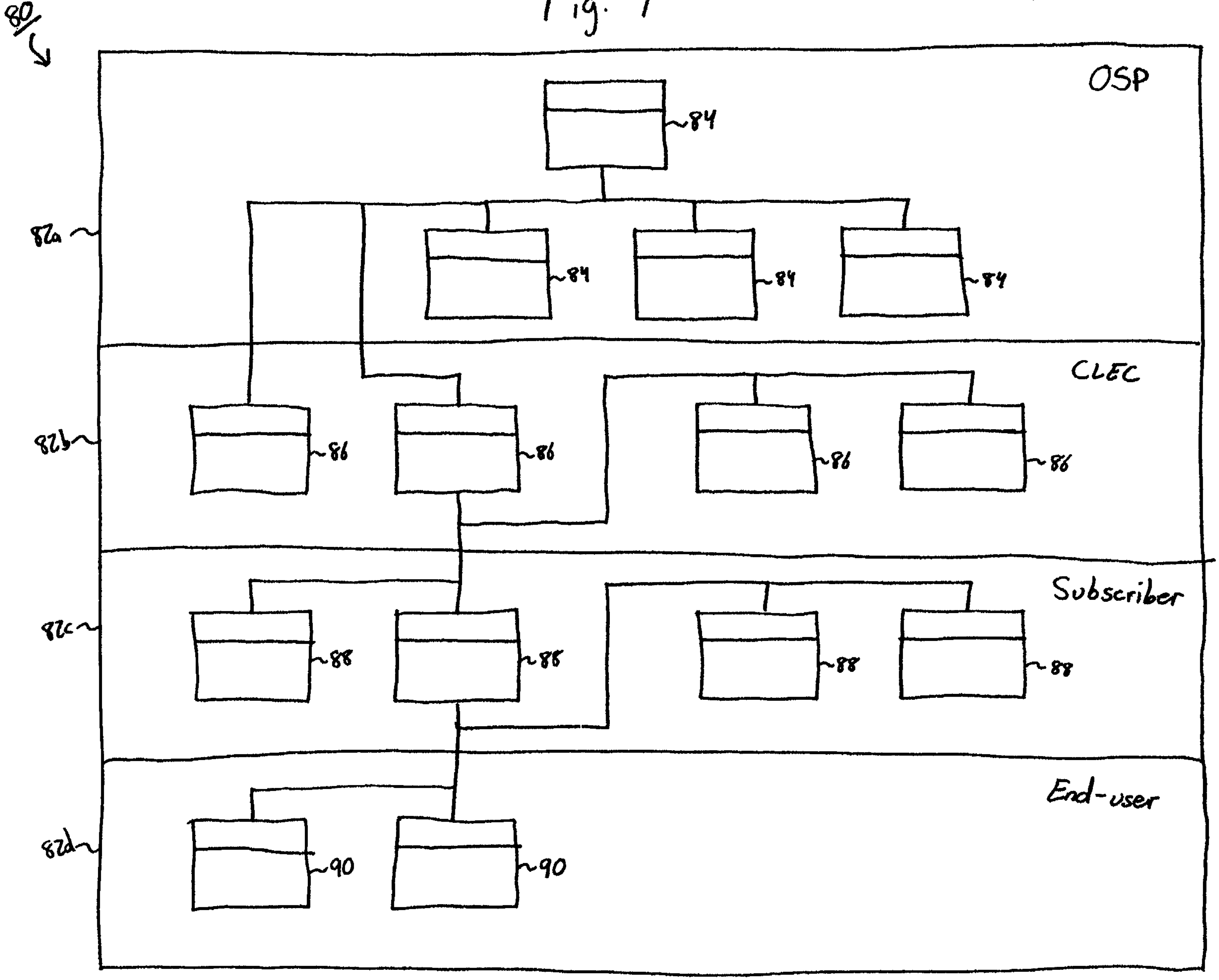

RDN
DN
C = US
C = US
72a
O=o1
O=o1, C = US
72b
OU = OU1
OU=OU1, O = o1, C=US
72c
Uid = U1
Uid=U1, OU=OU1, O=o1, C=US
72d

Fig. 8

Fig. 9



80
OSP
CLEC
Subscriber
End-user
82a
82b
82c
82d
84
84
84
84
86
86
86
86
88
88
88
88
90
90

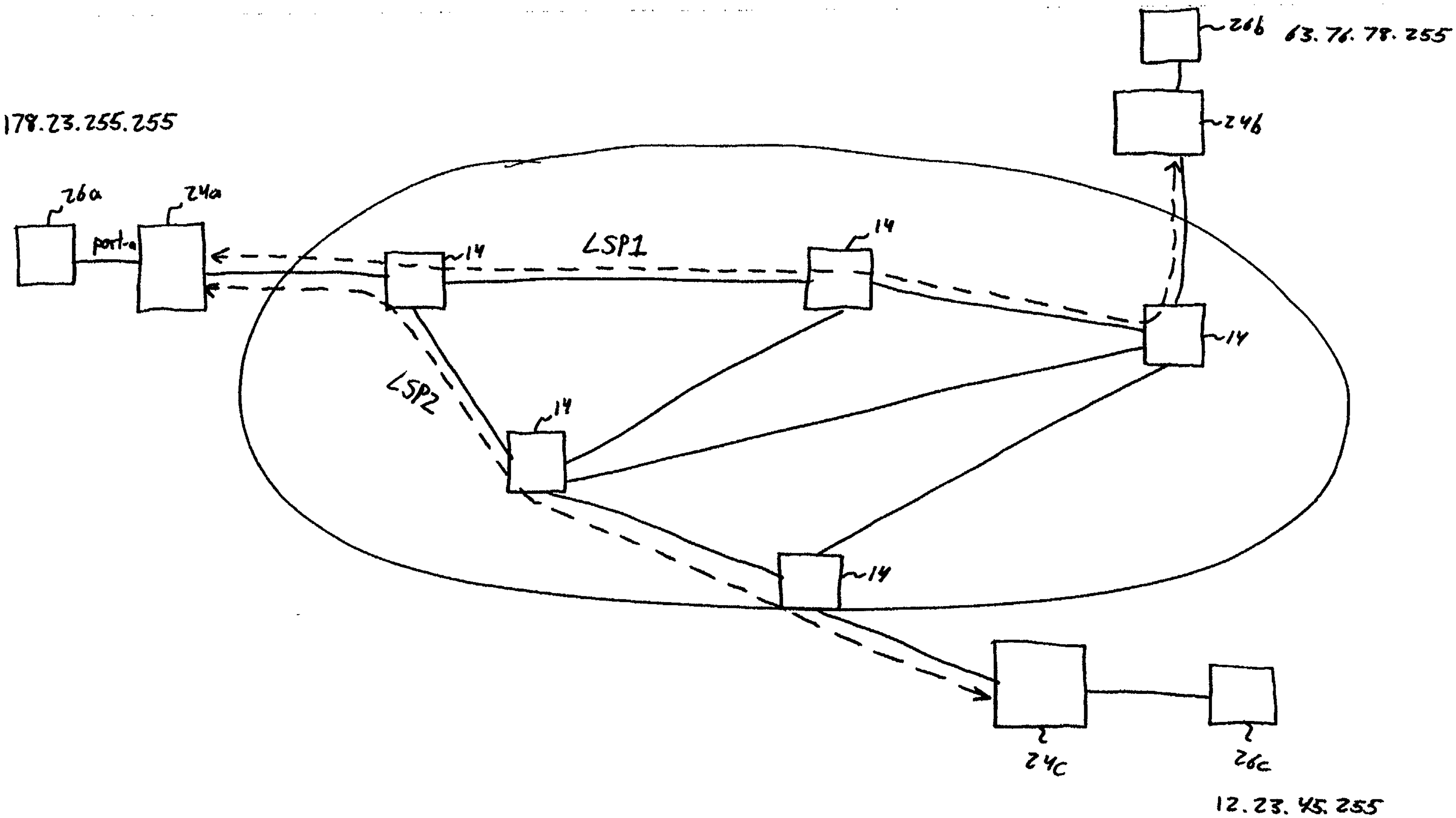

178.23.255.255
26a
24a
port-a
LSP1
LSP2
14
14
14
14
14
26b
63.76.78.255
24b
24c
26c
12.23.45.255

Fig. 10